The general relativistic theory of quasars*

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Abstract

In the papers physics/0007003 and arXiv:0705.2585 it has been shown that general relativity, due to the strong time dilation effects, really predicts, instead of the black holes, the existence of compact relativistic stars and relativistic galactic nuclei with (light and heavy) baryonic and quark content . Their surface radii are near the gravitational radii and they radiate with high gravitational redshift. The quasars can be interpreted as the such relativistic supermassive compact objects and their high redshifts has partly a gravitational origin. This additional mechanism of the redshift in addition to the Doppler shift leads to the normalization of main parameters of quasars as objects like to the compact galactic nuclei. The new prediction is that some of quasars may be relativistic stars in the Galaxy having high gravitational redshift. A short time variability of some quasars also can be naturally explained.

1 Introduction

The black holes, predicted by using some additional assumptions, do not convincingly revealed, but some of observing unusual objects are *interpreted* as probably containing black holes. At the same time, increasing number of quasars have been discovered with very high redshifts ($z \sim 6$). The such redshifts for the quasars can not be explained in the standard theory without assumptions about *extraordinary* masses, luminosities and small sizes and very large distances.

In the paper [1] a new treatment of the particle's motion in the Schwarzschild field in terms of the physical observables has been presented. In this new picture the contraction of the stat leads to its inhomogeneous freezing due to the strong time dilation effects, but the horizons and singularities can not be formed at any finite coordinate time moment. It is shown that the correctly formulated general relativity can naturally explain the quasars with the arbitrary high redshifts as relativistic stars or galactic nuclei of ordinary masses, luminosities, sizes and distances.

In the present paper this new interpretation of quasars in the framework general relativity will be shortly described.

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2 Particle's kinematics in a static field and the structure of relativistic stars

Let on a static frame a sample particle freely falls to a source from the spatial infinity. If the surface of the source is placed at $R > r_g$, here no problems with the Schwarzschild singularity.

In the new treatment [1] the particle can not infall into the interior region $R < r_g$ also due to the gravitational time dilation effects. This means also that a horizon and singularities disappear, the world lines of particles are continuous, the static frame is complete (does not contain unobservable regions), and all mechanical processes are reversible in time.

For a thin spherical dust shell freely falling in own gravitational field we come to the same conclusions as for the sample particle falling in the external field. Particularly, at $\tau = \tau_0$ the dust shell becomes frozen near own gravitational radius $R_a > r_{g(e)}$. At any finite coordinate time moment $t < \infty$ the horizon can not be formed, spacetime intervals for physical objects are timelike (or lightlike).

This fact and the results of the preceding considerations lead to a new picture for the stellar evolution including new families of compact relativistic stars with sizes near their gravitational radii.

The massive compact relativistic stars with $R > r_g$, have a finite volume and a finite density. Hence, the hierarchy of supercompact stars at ordinary and extraordinary physical states of matter do not stop on neutron star's level, but it should be continued to more dense physical states. For the stars with masses more than the critical mass of neutron star's stability $M > (3 \div 5)M_\odot$ the family of stable states can appears. The first one is the family of *heavy baryon stars,* containing baryonic resonances $(\Lambda, \Sigma, \Xi, \Delta)$. The *multiquark hadron stars* and *quark stars,* which appear after the quark-hadron phase transition, also can be considered.

Some of the observing candidates to black holes can be one of above mentioned type of stars. The searches of the supermassive stars containing subquarks or other types of substituents of quarks and leptons (*subquark stars),* heavy particles of the grand unification also become meaningful search programs without any gravitational restrictions.

In the next section the theory of quasars as the relativistic stars or relativistic galactic nuclei will be presented as a direct consequence of general relativity formulated without additional contradictory hypotheses.

3 Quasars as relativistic stars and galactic nuclei

Quasars in astrophysics are defined as *the point sources of radiaion with high redshifts of their spectral lines.* Since stellar redshifts in the standard treatments of general relativity has been restricted at $z < 0,2$ with maximal value for the neutron stars, the standard interpretation of quasar's high redshift mechanism has been reduces to the cosmological Doppler redshift only. In this interpretation the luminosities of quasars, the sizes of which are very small with respect to galaxies ($< 1ps$), nevertheless, $10^3 \div 10^5$ times exceed the luminosities of galaxies. The distances then must be $(0.1 \div 5) \times 10^9 ps$. Many quasars have broad emission lines and some of them have also absorption lines with sufficiently less values of redshifts than the emission lines of the same quasar. At the such extraordinary parameters some of quasars

are variable, and their luminosity changes $2 \div 3$ times during a very short time.

In the present treatment of relativistic stars no direct restrictions for the redshifts of superdense states.

Thus, two statements of the new theory of relativistic stars, the first one that no horizon and the superdense matter forms new types of stars and galactic nuclei, and the second one that no restrictions for the stellar and extragalactic objects redshifts, lead to the new general relativistic theory of *quasars as the relativistic galactic nuclei,* and for some of them *as the compact stars in the Milky Way.*

A part of redshifts of quasars, therefore, contains *the gravitational redshift*, since they are supercompact objects having a surface near the gravitational radius. In the case of galactic nuclei the cosmological Doppler redshift must be separated from the total redshift by some astrophysical methods. If the gravitational part of the redshift can be determined independently, then we can separate the Doppler part and determine true distances up to the quasars. But in both cases *the distances, luminosities and masses of extragalactic quasars become sufficiently less than modern standard estimations* and they become normal with respect to the analogous parameters of galactic nuclei.

The redshift differences between the absorption and emission lines may be explained partly by the existence of absorbing layers (photosphere) near the surfaces of the quasars. Really, a small difference of radii (few percent from r_g) between layers leads to large redshift differences ($\Delta z \sim 0.1 \div 1.0$).

Up to now quasars have been considered only as the extragalactic large distance and very massive ($10^9 \div 10^{12} M_\odot$) objects due to the Doppler shift explanation of their redshifts. If we treat the redshift partly as the gravitational one, then for some of quasars *main part of the observed redshift may has a gravitational origin.* The such quasars may be in the local group of galaxies and here we can obtain a useful information about the dynamics and the structure of quasars and models of the galaxies evolution.

A new prediction of the present theory of quasars, which can be checked by observations, is that for some of objects, catalogued as quasars, *the total redshift may be only the gravitational redshift*, and that *in the Milky Way and neighbor galaxies the stellar mass quasars may exist as the relativistic stars with high gravitational redshifts.* The microquasars are also should be considered as the candidateds for the such objects.

A particle content of the such "stellar quasars" is not sufficient for our purposes in this paper since the same value of redshift may be in the case of various relativistic stars with different particles (neutrons, hyperons, quarks) and masses ($5 \div 100\ M_\odot$).

The searches of the such quasars in the Galaxy, or identification of some known quasars (in the equatorial zone of the Galaxy) as the relativistic stars will be very important for the verification of the general relativistic theory of stellar structures.

References

[1] Zakir Z. (2000) *General relativity as a complete theory and its new consequences.* 13 p., (physics/0007003; see also: physics/0005009), in "Z.Zakir (2003-2007) *Structure of Space-Time and Matter*. CTPA, Tashkent".